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10/031,240	04/02/2002	Roger W. Whatmore	111675	6309

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EXAMINER

SUMMONS, BARBARA

ART UNIT PAPER NUMBER

2817

DATE MAILED: 09/04/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/031,240

Applicant(s)

WHATMORE ET AL.

Examiner

Barbara Summons

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js

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 1/17/02 (Pre-Amdt).
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-11 and 13-30 is/are rejected.
- 7) ☒ Claim(s) 12 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 3.
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Specification

1. The disclosure is objected to because the appropriate headings need to be provided for the sections of the specification as required by 37 CFR 1.77(b). For example, "BACKGROUND OF THE INVENTION" on page 1, on line 7; "SUMMARY OF THE INVENTION" on page 3, line 8; "BRIEF DESCRIPTION OF THE DRAWINGS" on page 6, line 21; and "DETAILED DESCRIPTION" on page 8, line 8.

Appropriate correction is required.

Drawings

2. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the piezoelectric structure being "supported on an acoustic reflective stack" as recited in claim 3, must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Claim Objections

3. Claim 28 is objected to because of the following informalities:

In claim 28, on line 2, "FBAR series" should be - - FBAR in series - -.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claim 30 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite in that it fails to point out what is included or excluded by the claim language. This claim is an omnibus type claim.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 1, 7, 10, 14, 15, 20, 25, and 27-29 are rejected under 35 U.S.C. 102(b) as being anticipated by Curran et al. U.S. 3,549,414.

Figs. 3 and 4 of Curran et al. disclose an electric filter comprising a plurality of thin film (see e.g. col. 5, ln. 22) bulk acoustic resonators (FBARs) linked in series (resonators A and C) /parallel (resonator B) arrangement wherein each resonator is made up of a thin piezoelectric layer 24 (col. 3, ln. 55) of uniform thickness (col. 6, ln.

25) sandwiched between two metal electrodes 26 (col. 6, Ins. 26-28) and other layers of materials 34 and in which the thicknesses of the non-piezoelectric layers 34 in the series and parallel resonators is varied one from another (see col. 6, Ins. 53-60).

Regarding claims 7, 20 and 27, the layer 34 is an additional dielectric layer of silicon oxide (see element 22 in Fig. 1 and col. 5, Ins. 20-25) overlying the top electrode.

Regarding claims 10, 14 and 15, the piezoelectric is lead titanate zirconate (see col. 4, In. 33), and the electrodes can be gold or aluminum (see col. 3, Ins. 62-65).

Regarding claim 29, although only one parallel resonator is shown, more are disclosed (see col. 6, Ins. 45-47).

8. Claims 1-4, 6, 7, 9, 11, 14, 15, 18, 20-29 are rejected under 35 U.S.C. 102(b) as being anticipated by Ella EP 0 949 756 A2 (cited by Applicants).

Regarding claims 1, 2, 4, 6, 25, 26, 28, and 29, Figs. 8f and 1a disclose an electric filter comprising a plurality of FBARs (see pg. 2, Ins. 6-7) linked in series (43 and 45)/parallel (42 and 46) arrangement wherein each of the resonators is made up of a thin piezoelectric layer 22 (see Fig. 1a) sandwiched between two metal electrodes 24 and 26, and other layers of materials (e.g. membrane 28 with layers 30 and 32), and in which the thicknesses of the non-piezoelectric layers in the FBAR series and parallel resonators are varied one from another (i.e. either the membrane layers or the top electrode layers see pg. 3, Ins. 1-7).

Regarding claim 3, see Fig. 3a. Regarding claims 7, 18, 20 and 27, membrane layer 30 is considered an "overlying" layer because it overlies the lower membrane layer

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32 and will be thicker in the parallel resonators (see pg. 3, Ins. 2-4), and membrane layer 30 is also an additional layer that is under the bottom electrode and it is formed of silicon oxide (see pg. 14, Ins. 12-15).

Regarding claims 9, 11, 14 and 15, the piezoelectric layer 22 is zinc oxide or aluminum nitride (see pg. 14, Ins. 10-12) and the electrodes 24 and 26 are gold or aluminum (pg. 14, Ins. 16-19).

Regarding claims 21-24, these claims are "product-by-process" claims and the product has been disclosed as discussed above. "Even though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. *In re Thorpe*, 227 USPQ 964,966 (Fed. Cir. 1985) (citations omitted). [See also MPEP § 2113]. Note that this reasoning applies to all subsequent rejections.

9. Claims 1-3, 8, 9, 11, 15, and 21-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Rittenhouse et al. U.S. 6,337,136.

Figs. 8 and 9 of Rittenhouse et al. disclose an electric filter with a plurality of series/parallel FBARs (a.k.a. thin film resonators TFRs) each FBAR having a piezoelectric layer 110 (Fig. 8) made of ZnO or AlN (see col. 1, Ins. 22-23), and upper and lower electrodes 105,115 made of aluminum (col. 1, Ins. 23-25), supported by either a membrane or a reflective stack (col. 1, Ins. 18-20), and wherein a thickness of non-piezoelectric layers of the FBARs in series and in parallel is varied one-from another. The varied thickness layer is an overlying metal layer 116 (which has zero

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thickness on the resonators it is not disposed on), or the thickness of the top electrode is considered varied by the addition of metal layer 116 (col. 6, Ins. 3-25).

10. Claims 1-4, 7, 8, 11, 14, 15, and 20-29 are rejected under 35 U.S.C. 102(e) as being anticipated by Barber et al. U.S. 6,307,447.

Figs. 1-3 of Barber et al. disclose an electric filter with a plurality of series/parallel FBARs (see col. 5, Ins. 30-37 center resonator is parallel) each having a piezoelectric layer 18 made of AlN (col. 1, Ins. 34-36), and upper and lower electrodes made of aluminum or gold (col. 6, Ins. 33-37 and col. 7, Ins. 35-37), supported by either a membrane (col. 4, Ins. 32-47 and col. 1, Ins. 26-29) or a reflective stack (Fig. 1), and wherein a thickness of non-piezoelectric layers of the FBARs in series and in parallel is varied one-from another (see col. 5, Ins. 52-57). The varied thickness is either a top electrode (col. 5, Ins. 62-64), or an additional layer 46 which is either another metal or a dielectric layer of a silicon oxide (see col. 6, Ins. 25-40). Note the different thicknesses can be produced via wet etching or reactive ion etching (see col. 7, Ins. 58-64).

Claim Rejections - 35 USC § 103

11. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

12. Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ella EP 0 949 756 (cited by Applicants) in view of Ruby et al. U.S. 5,587,620.

Ella discloses the invention as discussed above, except for disclosing the membrane being a silicon oxide rather than a silicon nitride.

Ruby et al. shows an analogous art FBAR (see Fig. 8) having a membrane 204 formed of silicon nitride.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Ella such that the membrane would have been silicon nitride, because such an obvious modification would have been the mere substitution of art recognized equivalent membrane layers for FBARs, as evidenced by Ruby et al. (see e.g. Fig. 8 and col. 5, lns. 13-15) and as would have been known by one of ordinary skill in the art.

13. Claims 8 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ella EP 0 949 756 (cited by Applicants) in view of Mang et al U.S. 5,692,279.

Ella discloses the invention as discussed above except for disclosing the different thicknesses being of an overlying metal layer or an overlying dielectric layer of silicon nitride.

Ella does disclose that the different frequencies of the series/parallel resonators be provided by having layers of the resonators with different thicknesses (see pg. 2, Ins. 48-50) and gives some examples for how to do this (see pg. 3, Ins. 1-7).

Mang et al. discloses that it is known to provide different frequencies for series/parallel (lattice) FBARs by providing a different thickness of the top electrode by adding an overlying metal layer 27 (Fig. 4)[col. 4, Ins. 60-65] or dielectric layer of silicon oxide or silicon nitride (ibid.).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Ella by having provided a different thickness of an overlying metal layer or overlying dielectric layer of silicon nitride rather than different thicknesses of the membrane layers or the top electrode layers because such obvious modifications would have been merely all art recognized equivalent ways of providing the different frequencies between the series/parallel FBARs as evidenced by Mang et al. (see Fig. 4 and col. 4, Ins. 60-65), and because Ella suggested that the thicknesses of any layers may be changed (see pg. 2, Ins. 48-50) and merely gave two "example(s)" of how to do this (see pg. 3, Ins. 1-7 especially line 1), thereby suggesting to one of ordinary skill changing thicknesses of other layers, as shown, for example, by Mang et al., would have been equivalently usable therewith.

14. Claims 5 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ella EP 0 949 756 (cited by Applicants) in view of Lakin U.S. 5,894,647.

Ella discloses the invention as discussed above, except for changing the thicknesses of the lower electrodes or an overlying metal layer between the series/parallel resonators.

Lakin discloses that thicknesses of the top electrodes can be changed by adding an overlying metal layer 17 (Fig. 3), or equivalently, the thicknesses of bottom electrodes can be varied by adding a metal layer 17 to provide different resonator frequencies (see Fig. 3 and col. 6, Ins. 18-30).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Ella by having provided a different thickness of an overlying metal layer or a different thickness of a bottom electrode because such obvious modifications would have been merely art recognized equivalent ways of providing different frequencies in the series parallel FBARs as explicitly suggested by Lakin (col. 6, Ins. 18-30) and because Ella suggested changing the thicknesses of any resonator layers (pg. 2, Ins. 48-50).

15. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ella EP 0 949 756 (cited by Applicants) in view of Tani et al. U.S. 6,093,338.

Ella discloses the invention as discussed above, except for a piezoelectric layer of bismuth sodium titanium oxide.

Tani et al. discloses that piezoelectrics of bismuth sodium titanium oxide are known in the piezoelectric resonator art (see col. 9, Ins. 3-10 and 28-32 and functional thin film at col. 27, Ins. 53-54).

Consequently, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Ella such that the piezoelectric material would have been bismuth sodium titanium oxide, because such an obvious modification would have been the mere substitution of art recognized interchangeable piezoelectric materials (see interchanged with PZT in Tani col. 27, Ins. 53-54) in the piezoelectric resonator art and would have provided the benefits of having excellent piezoelectric properties as suggested by Tani (see e.g. col. 9, Ins. 28-32).

16. Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Ella EP 0 949 756 (cited by Applicants) in view of Ruby et al. U.S. 6,060,818.

Ella discloses the invention as discussed above, except for platinum electrodes.

Ruby et al. discloses that platinum electrodes and gold and aluminum electrodes are known alternate interchangeable electrode materials in the FBAR art (see col. 5, Ins. 32-35).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the filter of Ella by having provided the electrodes be substantially platinum, because such an obvious modification would have been the mere substitution of art recognized alternate interchangeable electrode materials in the FBAR art as suggested by Ruby et al. (ibid.).

Allowable Subject Matter

17. Claim 12 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

18. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Barber et al. U.S. 6,339,276 discloses mass loading resonators with overlying layers to change their frequency.

Tikka et al. U.S. 6,407,649 discloses FBAR ladder filters with the parallel resonators having a tuning layer by the top electrodes (Fig. 5) or bottom electrodes (transmitter filter in Fig. 7).

Ella U.S. 6,388,544 discloses that the tuning of lattice filters is the same as for ladder filters and is provided by different thicknesses of layers or using an additional layer (see col. 3, ln. 63 to col. 4, ln. 3).

Ruby et al. U.S. 6,469,597 discloses tuning of FBARS to different frequencies with different thicknesses of the top electrodes (Figs. 3A and 3B), adding a layer to the top electrode (Fig. 2) or to the bottom electrode (Fig. 4).

Ylilammi U.S. 6,051,907 discloses tuning FBARs in a ladder filter (Fig. 9) by changing thicknesses of top electrodes (Fig. 4) or a membrane (Figs. 6a and 6b).

Ella et al. U.S. 6,441,702 discloses tuning FBARs by etching with an ion beam (ion milling) or reactive ion etching or laser (see col. 4, Ins. 53-55 and 60-64) any layer that happens to be the top layer at that stage of manufacture (see col. 35-35-40).

19. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Barbara Summons whose telephone number is (703) 308-4947. The examiner can normally be reached on M-Th, M-Fr.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bob Pascal can be reached on (703) 308-4909. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

A handwritten signature in black ink that reads "Barbara Summons". The signature is written in a cursive style with a long horizontal line extending from the end of the name.

bs
August 20, 2003

Barbara Summons
Primary Examiner
Art Unit 2817